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DETECTION OF BORON IN PETROLEUM ASHES

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[A Digest]

On the basis of our work and work done abroad [1, 2], we know that petroleum ashes of different origin contain the following elements: Fe, Ca, O, S, Mg, Na, V, Si, Al, Ti, Cu, F, Mn, Cr, Th, Sr, Ba, Co, P, Sn, Zn, U, Li, Mo, Pb, Be, As, Bi, Cd, Ge, Ag, Au, Cl, and I. This has been established by chemical and spectroscopic analysis.

The elements C, H, and N are also contained in petroleum, but they volatilize in the process of combustion. This also applies to some halogens. Thus petroleum contains all elements composing the biosphere [3] with the exception of boron, which has not been detected hitherto. The reason for this is that chemical detection and qualitative determination of boron are rather difficult, while spectroscopic determination with the use of carbon electrodes is impossible, because the carbon of the electrodes contains boron. We noticed in the analysis of petroleum ashes, however, that the intensity of the boron lines is often higher than that which would be produced by the boron of the carbon electrodes alone.

In order to determine the boron content of the ashes precisely, we used copper electrodes which do not contain boron. The measurements were carried out on an ISr-22 quartz spectrograph (from the GOXZ plant) with the use of a direct current arc of 110 v potential and 5-6 a current. Three samples of ash from petroleum originating from Turkmenia and Nebit-dag wells were investigated. The ash content of the filtered samples of petroleum was 0.05, 0.006, and 0.007% respectively. For comparison samples composed of quartz powder, a definite quantity of boron added in the form of H_3BO_3 , and the same quantities of the elements V, Mo, Mn, Cr, and Ni were used. Using a

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range of concentrations corresponding to 1, 0.5, 0.3, 0.1, 0.03, 0.01, 0.003, and 0.001% B, intensity curves of the boron lines and those of the other elements were taken with a photoelectric microphotometer MF-1 (from the GOMZ plant), showing that boron was distributed in accordance with its concentration. The boron in the samples of petroleum ash was then determined by comparing the spectra with the spectra of the standard samples taken on the same film. The result was that sample no. 1 was found to contain ~0.3% B, no. 2 ~0.01% B, and no. 3 no boron at all.

A supplementary examination of petroleum ashes derived from vents, Amba, Terpana, and Turkmenian petroleum ash, Abit-dan, Urmaly, and others, showed that boron was also present in the petroleum ashes. Although the fact that the carbon electrodes may have contained boron was taken into consideration, the intensity of the lines still indicated that practically all of the ashes of crudes from the localities indicated above contain boron. The highest intensity of the boron lines was observed in some ashes from Turkmenian petroleum.

One may speculate on the origin of the boron in petroleum. The boron may be derived from surrounding bedded rocks and petroleum waters. All petroleum waters contain 0.002-0.021 g/liter of B_2O_3 [4]. Bedded rocks contain 0.01-0.1% B_2O_3 , soils 0.001% B_2O_3 [5]. Sea water contains 4.5×10^{-4} g/l. The boron may have come from any of these sources. The fact that the boron is not removed completely by washing with distilled water suggests that it may be of organic origin, however. Various marine and land plants contain boron and so does coal [5]. It is not out of the question that the boron in petroleum is derived from plants, and is thus of primary origin.

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